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OPERATOR'S MANUAL

VOLT-OHM-MILLIAMMETER
MODEL 270

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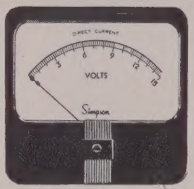

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OPERATOR'S MANUAL

VOLT-OHM-MILLIAMMETER
MODEL 270

SIMPSON ELECTRIC COMPANY

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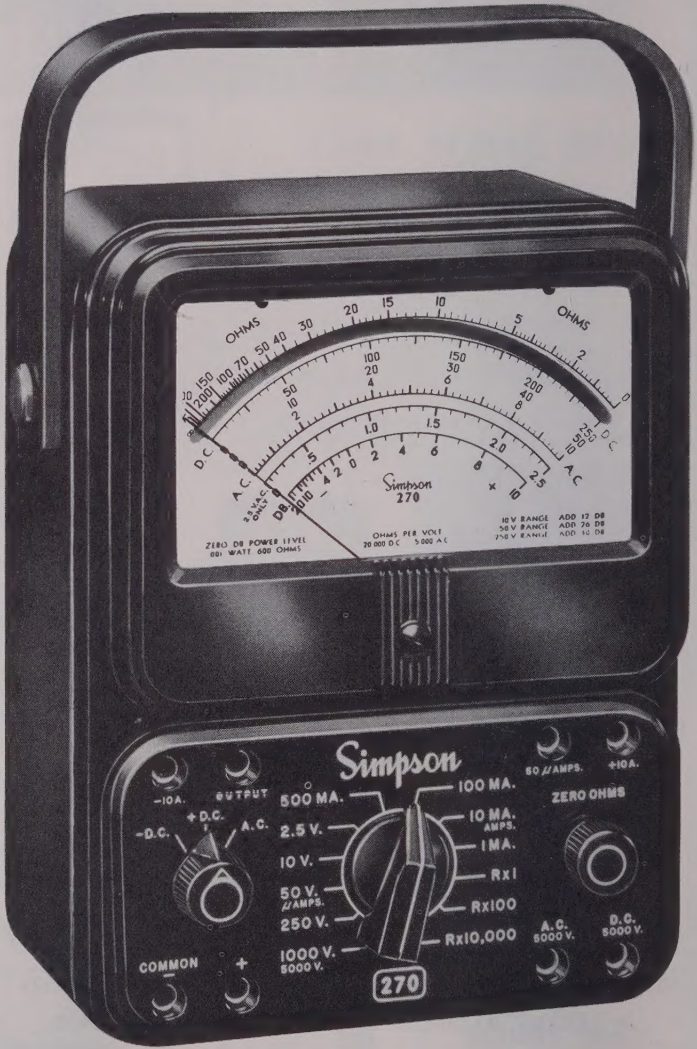


FIG. 1. SIMPSON VOLT-OHM-MILLIAMMETER MODEL 270

SECTION I

GENERAL DESCRIPTION

The Simpson Volt-Ohm-Milliammeter Model 270 is a multi-range, multi-scale instrument which provides the greatest accuracy consistent with its truly rugged portability. Every electrical component of the Model 270 is a major improvement over components found in the average multitester.

Specifically, the following new and improved features are incorporated to give the higher accuracy and stability.

1. ½% high flux movement with virtually no friction.
2. ½% precision stabilized wire wound and deposited carbon resistors.
3. Mirror scale and knife edge pointer to permit precision measurements and set-in of standard voltages and currents as demanded in critical development work.
4. Top quality, gold bonded germanium diodes provide higher precision and stability on AC ranges over a wide temperature range (See specifications, page 9).
5. Predictable temperature response on all ranges.
6. Permanent elimination of error-producing effects of electrostatic charge on high voltage ranges.

PHYSICAL

FRONT PANEL

The instrument has a large easy-to-read 4½" meter at the top of the front panel. Below the meter are three operating controls and eight circuit jacks. All switch positions and circuit jacks are deeply engraved with white lettering on black bakelite to insure long time readability.

RANGE SWITCH

The range switch, in the center of the lower part of the front panel, has 12 positions. It may be turned in either direction to obtain any desired range and circuit position. There are six voltage ranges for D.C. and six for A.C., six ranges for direct current, and three resistance ranges.

FUNCTION SWITCH

The function switch is located at the left hand side of the lower part of the front panel. It has three positions: −D.C., +D.C., and A.C. When direct current, D.C. voltage, or resistance is to be measured, the function switch may be set at −D.C. or +D.C., depending on the polarity of current or voltage. Reversing the test lead connections without removing them from the circuit under test is accomplished by using the function switch.

ZERO OHMS

The control at the lower right on the panel is marked ZERO

OHMS. This variable resistance in the ohmmeter circuit is used to compensate for the aging of the internal batteries. Use it to adjust the meter indication to zero (at the right end of the scale) with the test leads shorted together whenever the ohmmeter circuit is used.

CIRCUIT JACKS

There are eight jacks, two being located in each corner of the front panel. These are the connection points for the test leads. Plug the prods of the test leads into the proper jacks to obtain the circuit and range desired for each application.

At the lower left are COMMON − and + jacks. These are the jacks that will be used most. Connect the black test lead to COMMON − for all circuits and ranges except 10 amperes D.C. Connect the red test lead to the + jack for all circuits and ranges except those designated by the other circuit jacks.

Across the top of the panel are jacks marked −10 A., OUTPUT, 50μAMPS, and +10 A. For all audio frequency output voltage ranges, use the red test lead connected to the OUTPUT jack. For the 50 microampere or 250 millivolt D.C. range, use the red test lead connected to the 50μAMPS jack. For the 10 ampere D.C. range, use the black test lead in the −10 A. jack and the red test lead in the +10 A. jack.

PRINTED CIRCUIT

Conforming to the latest engineering developments, almost all the component parts of the Simpson Model 270, are mounted in a printed circuit. This simplifies assembly, reduces maintenance, and extends the useful life of the instrument (See page 28 for removal instructions).

BAKELITE CASE

The Simpson Model 270 is housed in a heavy black bakelite case. It is molded with heavy reinforced walls for maximum durability. All the component parts in the Model 270 are attached or mounted to the front panel: the entire instrument slips into and out of the case in one piece.

ADJUST-A-VIEW HANDLE

The comfortable handle is attached on each side of the instrument case. The handle may be used to support the instrument in a convenient sloping position for easy viewing on the bench top. Of course, the Model 270 can also be placed in either a vertical or horizontal position (see note at bottom of page 9).

TEST LEADS

Each Simpson Volt-Ohm-Milliammeter Model 270 is furnished with one pair of four-foot test leads. One lead is black and the other red for easy polarity identification.

The wire is very finely stranded and extra-flexible. Its insulation is a special high-grade rubber which has far

more insulation strength than the highest voltages to which your instrument will ever be subjected.

FUSE PROTECTION

The Simpson Volt-Ohm-Milliammeter Model 270 is provided with a fuse which protects the tester circuits from misuse on the ohmmeter ranges and from excessive overload on the milliampere ranges.

SIZE AND WEIGHT

The Model 270 measures 5¼" x 7" x 3-1/8". It weighs 3¼ pounds.

ELECTRICAL

MEASUREMENT RANGES

D.C. VOLTAGE

Sensitivity; 20,000 ohms-per-volt

0 – 250 millivolts
0 – 2.5 volts
0 – 10 volts
0 – 50 volts
0 – 250 volts
0 – 1000 volts
0 – 5000 volts

A.C. VOLTAGE

Sensitivity; 5,000 ohms-per-volt

0 – 2.5 volts
0 – 10 volts
0 – 50 volts
0 – 250 volts
0 – 1000 volts
0 – 5000 volts

A.F. OUTPUT VOLTAGE

With 0.1 μf internal series capacitor

0 – 2.5 volts
0 – 10 volts
0 – 50 volts
0 – 250 volts

VOLUME LEVEL IN DECIBELS

With zero DB equal to 1 milliwatt across a 600 ohm line

–20 to +10 DB
– 8 to +22 DB
+ 6 to +36 DB
+20 to +50 DB

D.C. RESISTANCE

R x 1 for 0–2000 ohms (12 ohms center)
R x 100 for 0–200,000 ohms (1200 ohms center)
R x 10,000 for 0–20 megohms (120,000 ohms center)

DIRECT CURRENT

0 – 50 microamperes
0 – 1 milliampere
0 – 10 milliamperes
0 – 100 milliamperes
0 – 500 milliamperes
0 – 10 amperes

ACCURACY

The accuracies of all ranges are as follow:

Ranges	Accuracy* 77°F.	Accuracy 67° to 87°F.
DC Volts		
250MV thru 1000V.	±1½% of FS	±2% of FS
(FS means "Full Scale Value")		
5000V.	±2½% of FS	±3% of FS
Direct Current	±1½% of FS	±2% of FS
Ohms	±1½° of dial arc	±2° of dial arc
AC Volts		
(Dial calibrated for RMS value of a pure sine wave)		
2.5V thru 1000V.	±2% of FS	±3% of FS
5000V.	±3% of FS	±4% of FS

*These accuracies are guaranteed when the Model 270 is used with the meter dial in a horizontal plane.

In summary, the change in accuracy with a 10° Fahrenheit temperature change from 77°F. is ±½% on DC and ±1% on AC. These accuracy changes are linear over this temperature range, being ±0.05% per °F. on DC and ±0.1% per °F. on AC.

In order to apply the temperature correction factors indicated above, the temperature of the electrical elements of the Model 270 must be known. It can be assumed that this temperature is that of the area in which the Model 270 is being used if it has been in this area (or another area of very nearly equal temperature) for a period of at least four hours. This time lapse can be materially reduced by the removal of the Model 270 from its case and providing rapid air flow around the electrical elements.

The Model 270 has a 100 degree dial with the D.C. scale divided into equal intervals of 2 degrees each. The accuracies stated as "±x% of full scale value" can be directly visualized as "$\pm\frac{x}{2}$ divisions of DC scale." For example, "±2% of FS" is equivalent to saying "±1 division of DC scale." This is an exact method when measuring DC and close enough for practical purposes on the ohms, AC, and db scales.

INTERNAL BATTERIES

There are five 1.5 volt batteries inside the instrument. These are used for the ohmmeter circuits. One large cell is used to furnish 1.5 volts for the R x 1 and R x 100 ran-

ges. Four smaller cells are added in series to furnish 7.5 volts for the R x 10,000 range.

Each battery is held in place with two special spring clips which also serve as battery contacts. The polarity symbols are marked on the panel. Always observe polarity when replacing batteries. Do not use steel-clad batteries; the steel jacket acts as a magnetic shunt and changes the calibration of the meter.

FREQUENCY RESPONSE

Your Simpson Model 270 has an excellent frequency response for A.C. and A.F. voltage measurements. It is essentially "flat" through the range from 20 cycles per second up to 30,000 cycles per second. See pages 17 and 19 for frequency response curves.

TRANSPORT

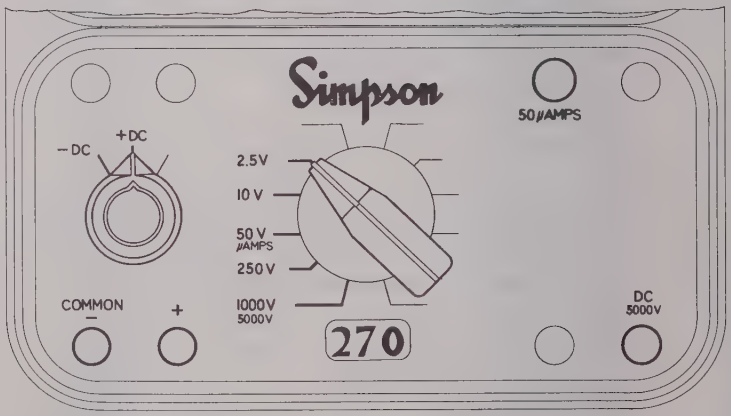
It is advisable to shunt the meter movement during transport. This is readily achieved by setting the function switch at D.C. and the range switch at 500MA.

SECTION II

OPERATING INSTRUCTIONS

CAUTION

Connecting test leads to an energized circuit can present personal and/or equipment hazards. Turn off power before attaching or removing test leads in or adjacent to high voltage circuits. This procedure applies particularly to a current measurement in an inductive circuit due to the presence of higher than normal voltages if the current circuit is opened.



CONTACTS AND SWITCH POSITIONS FOR D.C. VOLTS

ADJUST POINTER FOR ZERO

Before any measurements are made, check to see that the pointer indicates zero when the meter is in its operating position. If the pointer is off zero, adjust the screw located in the bakelite case below the center of the meter scale, as shown in Figure 1. Use a small screwdriver to turn this screw slowly clockwise or counterclockwise until the pointer is exactly over the zero mark at the left side of the scale.

D.C. VOLTAGE MEASUREMENTS, 0-250 MILLIVOLT RANGE ONLY

1. Set the function switch at +D.C.
2. Connect the black test lead in the COMMON – jack and the red test lead in the 50μAMPS jack.
3. Set the range switch at 50μAMPS (common position with 50 V.).
4. Connect the black test lead to the negative side of the circuit to be measured, and the red test lead to the positive side of the circuit.
5. Turn on power. If meter deflects to left of zero, turn off power and reverse the test lead connections. Then turn on power again.
6. Read the voltage on the black arc marked D.C., and use the figures marked 0 – 250; read directly in millivolts.
7. Turn off power in the circuit which is being measured before disconnecting meter leads.

D.C. VOLTAGE MEASUREMENTS, 0 – 1000 VOLTS

1. Set the function switch on the left hand side of the front panel at +D.C.
2. Plug the black test lead into the COMMON – jack and the red test lead into the + jack.
3. Set the range selector switch in any of the five voltage range positions. These are marked 2.5 V., 10 V., 50 V., 250 V., and 1000 V. When in doubt as to the voltage present, always use the highest voltage range as a protection to the instrument. Observe the meter reading. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading.
4. Connect the black test lead to the negative side of the circuit to be measured and the red test lead to the positive side of the circuit.
5. Turn on the power in the circuit to be tested. If the pointer deflects to the left of zero, the anticipated polarity is opposite the actual circuit polarity. Turn off the power in the circuit which is being tested. Set the function switch at –D.C., and turn on the power again. This will correct the polarity as applied to the meter.
6. Read the voltage on the black arc marked D.C. which is second from the top of the dial.

   For the 2.5 V. range, use the 0 – 250 figures and divide by 100.

   For the 10 V., 50 V., and 250 V. ranges, read the figures directly on the scale.

   For the 1000 V. range, use the 0 – 10 figures and multiply by 100.

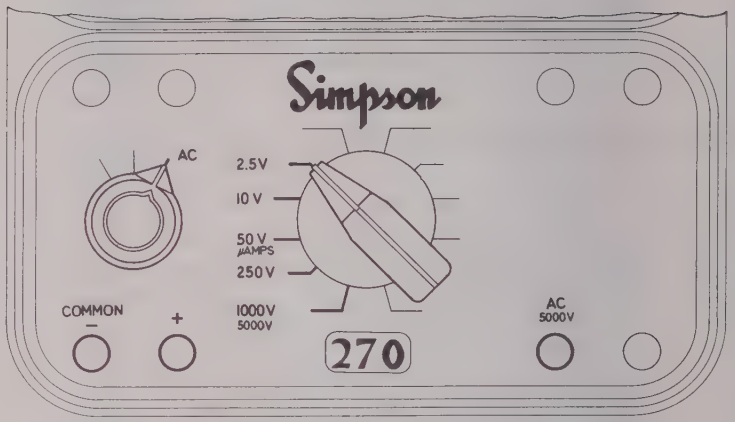
7. Turn off the power in the circuit which is being measured before disconnecting meter leads.

D.C. VOLTAGE MEASUREMENTS, 5000 VOLT RANGE

WARNING

Be extremely careful when working in high voltage circuits. Do not touch the meter or test leads while power is on in the circuit being measured.

1. Set the function switch at +D.C.
2. Set the range selector switch at 5000 V.
3. Connect the black test lead into the COMMON − jack and the red test lead into the D.C. 5000 V. jack.
4. Be sure power is off in the circuit to be measured and all capacitors have been discharged; connect the black test lead to the negative side of the circuit to be measured and the red test lead to the positive side of the circuit.
5. Turn on the power in the circuit. Do not touch the meter or test leads. If the pointer deflects to the left side of zero, the anticipated polarity is opposite the actual circuit polarity. Turn off the power in the circuit being tested. Set the function switch at −D.C., and turn on the power again. This will correct the polarity as it is applied to the meter.
6. Read the voltage using the 0 − 50 figures on the black arc which is second from the top of the scale. Multiply the reading by 100.
7. Turn off the power before disconnecting the test leads.



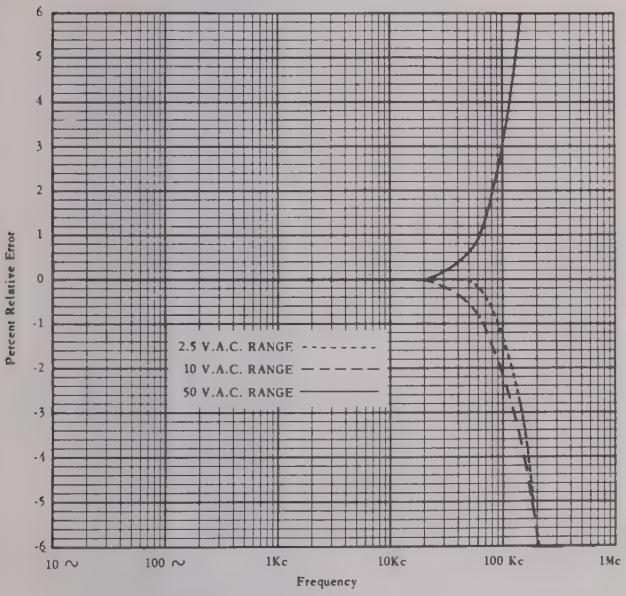
CONTACTS AND SWITCH POSITIONS FOR A.C. VOLTS

MEASURING A.C. VOLTAGES TO 1000 VOLTS

The Simpson Volt-Ohm-Milliammeter Model 270 measures A.C. voltage in terms of the R.M.S. value of a sine wave. This is accomplished by using two germanium diodes in a modified full wave bridge circuit.

The Model 270 has been especially designed to give a wide frequency response, making it useful over a range from 20 cycles per second to 200,000 cycles per second. The curve which follows shows the response of the 2.5, 10, and 50 volt ranges.

1. Set the function switch at A.C.
2. Set the range selector switch in any of the five voltage range positions, marked 2.5 V., 10 V., 50 V., 250 V., and 1000 V. When in doubt as to the voltage present,



FREQUENCY RESPONSE FOR MODEL 270

always use the highest voltage range as a protection to the instrument. Observe the meter reading. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading.

3. Plug the black test lead into the COMMON − jack and the red test lead into the + jack.
4. Be sure power is turned off in the circuit to be measured and connect the test leads across the voltage source.
5. Turn on the power in the circuit to be measured.

   For the 0−2.5 V. range, read the value directly on the special arc marked 2.5 V.A.C. ONLY.

For the 10 V., 50 V., and 250 V. ranges, read the red arc marked A.C., and use the red figures directly below the arc.

For the 1000 V. range, read the red arc marked A.C.; use the 0 – 10 figures and multiply by 100.

MEASURING A.C. VOLTAGE TO 5000 VOLTS

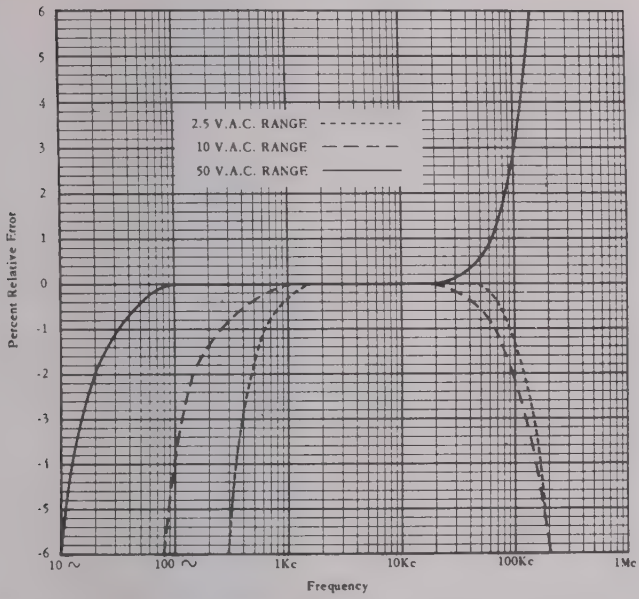
WARNING

Be extremely careful when working in high voltage circuits. Do not touch the meter or test leads while power is on in the circuit being measured.

1. Set the function switch at A.C.
2. Set the range selector switch at 5000 V.
3. Connect the black test lead into the COMMON – jack and the red test lead into the A.C. 5000 V. jack.
4. Be sure the power is off in the circuit to be measured and that all its capacitors have been discharged. Connect the test leads into the circuit.
5. Turn on the power in the circuit to be measured. **Do not touch the meter or test leads.**
6. Read the voltage on the red arc marked A.C.; use the 0 – 50 figures and multiply by 100.
7. Turn off the power before disconnecting the test leads.

MEASURING OUTPUT VOLTAGES

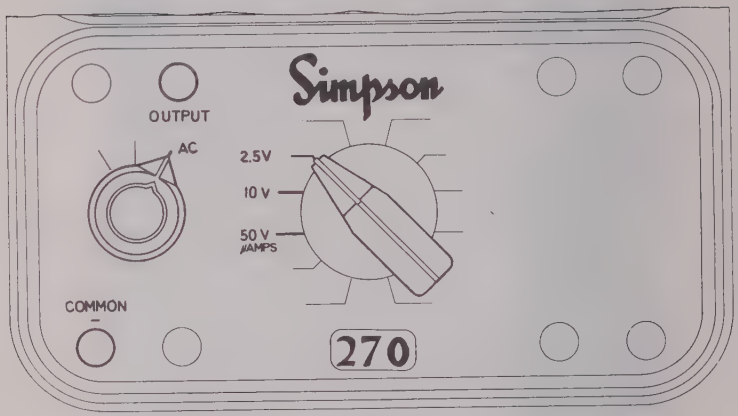
An output voltage is the A.C. component only, when there is a mixture of A.C. and D.C. voltages. This occurs mostly in amplifier circuits.



FREQUENCY RESPONSE FOR OUTPUT MEASUREMENTS

The Model 270 has a capacitor in series with the OUTPUT jack. This blocks the D.C. component of the current in the measuring circuit, but allows the A.C., or desired component, to pass on to the meter circuit. The blocking capacitor placed in series with the A.C. voltage measuring circuits alters the A.C. response. The above curves show the frequency response of the 2.5, 10, and 50 volt ranges.

1. Set the function switch on the left hand side of the front panel at A.C.
2. Connect the black test lead in the COMMON − jack and the red test lead in the OUTPUT jack.



CONTACTS AND SWITCH POSITIONS FOR OUTPUT

3. Set the range selector switch at the desired range position. These are marked 2.5 V., 10 V., 50 V., and 250 V.
4. Connect the black test lead to the grounded side of the circuit to be measured, and the red test lead to the "hot" side.
5. Turn on the power in the circuit. Read the output voltage on the A.C. voltage arcs of the dial.

   For the 2.5 V. range, read the value directly on the special arc marked 2.5 V.A.C. ONLY.

   For the 10 V., 50 V., and 250 V. ranges, use the red arc marked A.C., and use the red figures directly below the arc.
6. Turn off the power in the circuit before disconnecting the leads.

MEASURING DECIBELS

For some applications, output voltages and audio frequency voltages are frequently measured in terms of decibels. The decibel scale (DB), at the bottom of the dial, is numbered from −20 through 0 to +10.

To measure decibels, read the DB arc after proceeding according to instructions for A.C. voltage measurements.

The DB readings obtained will be correct on an absolute scale if you are using a 0 DB power level of 0.001 watt in 600 ohms, and if the voltage which you read was measured across 600 ohms.

To obtain absolute DB values across 600 ohms:

For the 10 V. range, read the DB arc and add +12 DB to the reading.

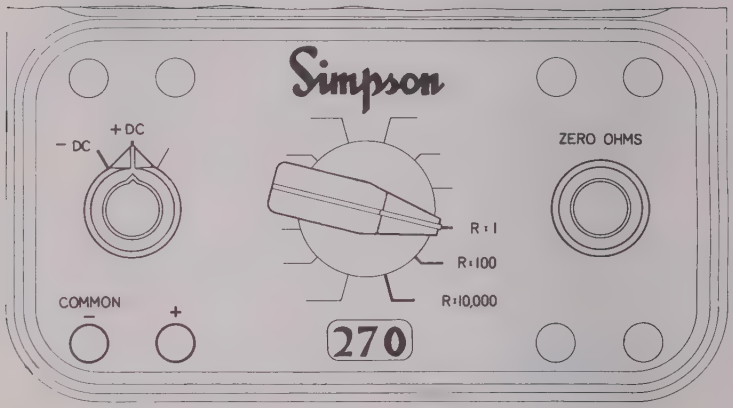
For the 50 V. range, read the DB arc and add +26 DB to the reading.

For the 250 V. range, read the DB arc and add +40 DB to the reading.

If the reference level is 0 DB = 0.006 watt in 500 ohms, subtract (+) 7 DB from the reading to obtain the absolute value of decibels.

OHMMETER CIRCUIT

Internal batteries are used to provide power for resistance measurements. Since the batteries are subject to deterioration over long periods of time, there is a compensating



CONTACTS AND SWITCH POSITIONS FOR RESISTANCES

circuit in the ohmmeter to make it possible to extend the useful life of the batteries.

ZERO OHMS ADJUST

Each time you use the ohmmeter circuit, check the zero indication on the meter before you measure any resistance. Check and adjust it each time you switch to a different range. To set the ZERO OHMS control, proceed as follows:

1. Set the range switch at one of the resistance range positions and the function switch at either −D.C. or +D.C.
2. Connect the black test lead in the COMMON − jack and the red test lead in the + jack.
3. Clip the contact end of the test leads together to short out the resistance circuit.

4. Observe the meter indication. It should read 0 on the right hand end of the OHMS arc, which is at the top of the dial.
5. If the pointer does not read 0, rotate the ZERO OHMS knob until it does. If you cannot bring the pointer far enough to read 0, one or more batteries need to be replaced. Never use steel-clad batteries; the steel jacket will act as a magnetic shunt on the meter and change its calibration.
6. When the pointer shows zero, unclip the shorted test leads; the ohmmeter circuit is now ready to measure resistance.

MEASURING RESISTANCES

To measure resistance, proceed as follows:

1. Set the range switch in one of the resistance range positions.
   Use R x 1 for resistance readings from 0 to 200 ohms.
   Use R x 100 for resistance readings from 200 up to 20,000 ohms.
   Use R x 10,000 for resistance readings above 20,000 ohms.
2. Set the function switch at either −D.C. or +D.C.
3. Connect the black test lead in the COMMON − jack and the red test lead in the + jack.
4. Short the test leads together and adjust for zero ohms (see instructions above).
5. Separate the test leads and connect them across the resistance which is to be measured. If there is a "for-

ward" and backward" resistance such as in semi-conductor rectifiers, switch back and forth between the two D.C. positions of the function switch to reverse this polarity.

NOTE

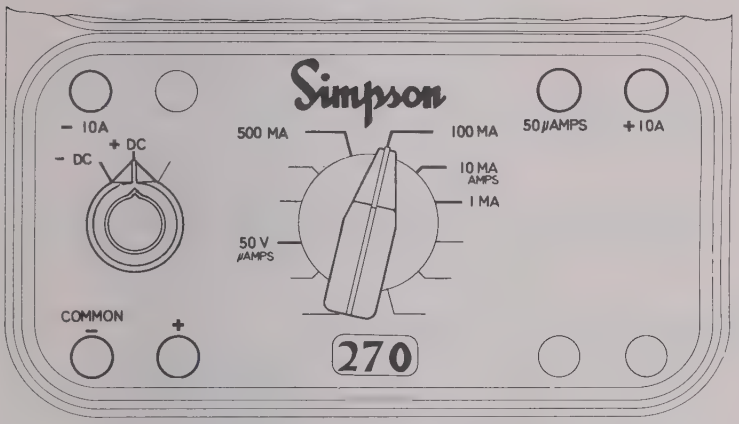
The resistance of such rectifiers will measure different values on different resistance ranges of the Model 270. Thus, a crystal diode which measures 80 ohms on the R x 1 range may measure 300 ohms on the R x 100 range. This is normal and is a result of the diode characteristic. The difference in values does not indicate any fault in the ohmmeter.

6. Read the indication on the OHMS arc at the top of the dial. Note that this arc reads from right to left for increasing values.
7. Multiply the reading by the multiplier factor at the switch position for the resistance value in ohms. "K" on the dial stands for "thousand".
8. Resistance measurements in transistor circuits should be made only after the transistor has been isolated from the circuit.

MEASURING DIRECT CURRENTS, 0 TO 50 MICROAMPERES

CAUTION

Never connect the test leads directly across any voltage when the Model 270 is used as a current



CONTACTS AND SWITCH POSITIONS FOR DIRECT CURRENTS

meter, except when it is used as a 0 – 250 millivoltmeter. This would damage the instrument. Always connect the meter in series with the load across the voltage source.

1. Set the function switch at +D.C.
2. Connect the black test lead in the COMMON – jack and the red test lead in the 50 μAMPS jack.
3. Set the range switch at 50 μAMPS (common position with 50 V.).
4. Open the circuit in which the current is to be measured. Connect the meter in series with the circuit. Connect the red test lead toward the positive side, and the black test lead toward the negative side of the circuit.
5. Turn on the power in the circuit which is to be measured. Observe the meter. If the pointer is deflected to

the left, the current polarity is opposite to that which was anticipated. Turn off the power and reverse leads.

6. Read the current directly on the black D.C. arc. Use the 0 – 50 figures. The current value is shown in microamperes.
7. Turn off the circuit power. Remove the test leads and restore the circuit continuity.

MEASURING DIRECT CURRENTS, 50 MICROAMPERES TO 500 MILLIAMPERES

1. Set the function switch at +D.C.
2. Connect the black test lead in the COMMON – jack and the red test lead in the + jack.
3. Set the range switch in any of the four range positions required. These are marked 1 MA., 10 MA., 100 MA., and 500 MA.
4. Open the circuit which is to be measured. Connect the meter in series with the circuit. Connect the red test lead toward the positive side and the black test lead toward the negative side of the circuit.
5. Turn on the power in the circuit which is to be measured. Observe the meter. If the pointer is deflected to the left, the current polarity is opposite to that which was anticipated. Turn off the power, set the function switch at –D.C., and then turn on the power again.
6. Read the current directly on the black D.C. arc.

   For the 1 MA. range use the 0 – 10 figures and divide by 10.

   For the 10 MA. range use the 0 – 10 figures directly.

For the 100 MA. range read the 0 – 10 figures and multiply by 10.

For the 500 MA. range read the 0 – 50 figures and multiply by 10.

The current values are in milliamperes.

7. Turn off the circuit power. Remove the test leads and restore circuit continuity.

MEASURING DIRECT CURRENTS, 500 MILLIAMPERES TO 10 AMPERES

1. Connect the black test lead in the −10 A. jack and the red test lead in the +10 A. jack.
2. Set the range selector switch at 10 AMPS (common with 10 MA.).
3. Open the circuit which is to be measured. Connect the meter in series with the circuit. Connect the red test lead toward the positive side and the black test lead toward the negative side of the circuit.
4. Turn on the power in the circuit which is to be measured. Observe the meter. If the pointer is deflected to the left, the current polarity is opposite to that which was anticipated. Turn off the power, reverse the test lead connections, and turn on the power again.
5. Read the current directly on the black D.C. arc. Use the 0 – 10 figures. The current values are in amperes.
6. Turn off the circuit power. Remove the test leads and restore circuit continuity.

SECTION III

MAINTENANCE

HOW TO OPEN THE CASE

The case of the Simpson Volt-Ohm-Milliammeter Model 270 has been designed to provide easy and quick access to the inside for all necessary adjustment and replacement of parts. Use a 1/4-inch screwdriver to remove the four screws through the bottom of the case. Then slip the entire front panel forward out of the case. The meter, the front panel, the printed circuit, and the batteries are all attached together and will come out as a unit.

BATTERY REPLACEMENT

There are five batteries inside the case of the Model 270. They are used to supply power for resistance measurements. One is a large size (#2, Size D) flashlight cell, and the other four are smaller (#Z) flashlight cells.

When it is no longer possible to bring the pointer to 0 for the R x 1 and R x 100 ranges (see ZERO OHMS ADJUST, page 22), replace the large cell with a fresh one. When it is no longer possible to bring the pointer to 0 on the R x 10,000 range, replace the four smaller cells with fresh ones. This will restore operation of the ohmmeter circuit.

Never use steel-clad batteries in the Model 270. The steel jackets will act as a magnetic shunt on the meter and change calibration.

OBSERVE POLARITY

When cells are replaced, be sure to observe the polarity of the battery circuit. The cells are each held in place with specially designed spring clips which also act as battery contacts. Battery polarity is shown on the panel.

SUB-PANEL PARTS PLACEMENT

Beneath each resistor on the printed circuit is its part number, as it is shown on the schematic diagram and in the parts list. This mark will eliminate any doubt which may arise as to the location of any of the resistors.

RECTIFIER REPLACEMENT AND RECALIBRATION

There are two small rectifiers which are located at the top of the printed circuit, near the large 1.5 volt cell. These are used to rectify the A.C. voltages for measurement. They are shown as D-1 and D-2 in the overall schematic diagram, Fig. 2.

Both rectifiers act in the meter circuit to effectively create a full wave rectifying action. If either or both should fail, the meter will show incorrect indications.

In case of rectifier failure, order a new rectifier from a Simpson Parts Depot (pages 37-39), specifying the part number as shown in the parts list. In order to maintain the accuracy of the Model 270, it is essential to replace rectifiers with the type furnished in the original unit.

After replacing either or both rectifiers, test the accuracy of A.C. voltage indications. If necessary, recalibrate the circuit by adjusting rheostats R-28 and R-31 as follows:

1. Set the function switch at A.C. and the range switch at 250 V.
2. Connect the red test lead in the + jack and the black test lead in the COMMON – jack.
3. From a standard voltage source, apply 250 volts A.C. to the red and black test lead. Adjust rheostat R-31 (which is next to the + meter stud on the printed circuit board) so the meter reads full scale. Turn power off.
4. Set the range switch to 2.5 V. Apply 2.5 volts A.C. to the red and black test leads. Adjust rheostat R-28 (which is next to R-31) so the meter reads full scale. Turn power off.

If no standard voltage supply is available for the above procedure, return your Model 270 to the Simpson Electric Company or an Authorized Warranty Repair Station for recalibration.

RESISTOR REPLACEMENT

Most of the resistors for the Simpson Model 270 are on the rear of the printed circuit. This makes them easily accessible for trouble-shooting and repair.

When it is necessary to replace any of the resistors in the circuit, first obtain an exact equivalent resistor. The best way to do this is to order the resistor or resistors directly

from a Simpson Parts Depot (pages 37-39), specifying the part number as shown in the parts list. Then clip the defective resistor off the printed circuit board, leaving the leads in the board to use as connections for the replacement.

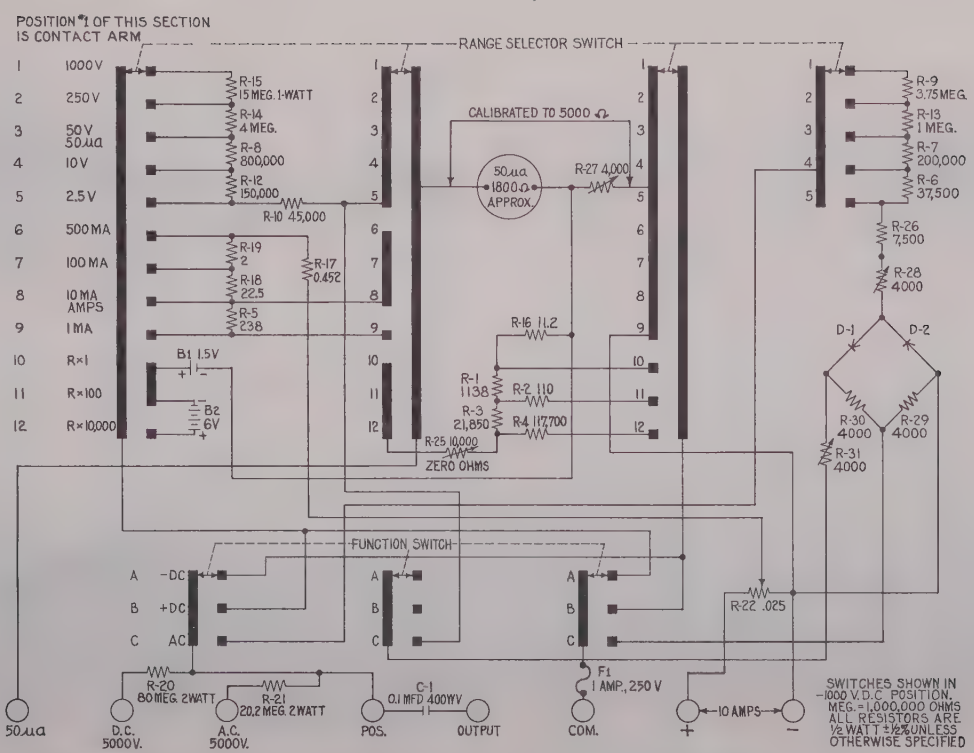
Carefully twist the leads for the new resistor around the leads left from the defective resistor, and solder each connection. Trim away all excess and check that no shorts have developed due to the substitution.

REMOVING THE PRINTED CIRCUIT

When access is required to the under-side of the printed circuit, or to the parts which are located between it and the front panel, remove the printed circuit.

Use the following procedure:

1. Set the function switch at +D.C. and the range switch at 2.5 V.
2. Remove the knob for the ZERO OHMS control.
3. Remove the two screws through the lower part of the printed circuit board.
4. Remove the two hex nuts from the meter studs on the top of the printed circuit board.
5. Carefully pry out the battery contact at the + terminal for the small 1.5 volt cells. This is connected to the upper left hand corner of the printed circuit board with an orange lead.
6. Lift the printed circuit board away from the front panel. The entire board, with the switch wafers in place, will come up in one piece.



OVERALL SCHEMATIC, SIMPSON VOLT-OHM-MILLIAMMETER, MODEL 270

7. After removal, do not turn knobs on front panel or move any rotors on switches until reassembled.

FUSE REPLACEMENT

Remove the front panel from the case and disconnect the burned-out fuse, using a small (60-watt or less) soldering iron. Replace with a 1 amp, 250 volt pigtail fuse, type 3AG or equivalent only.

PARTS LIST

Reference Symbol	Description	Simpson Part No.
R1	Resistor, 1138 ohms (all resistors ±½%)	1-117141
R2	Resistor, 110 ohms	1-117142
R3	Resistor, 21,850 ohms	1-117143
R4	Resistor, 117,700 ohms	1-117144
R5	Resistor, 238 ohms (bobbin)	10-805075
R6	Resistor, 37,500 ohms	1-117145
R7	Resistor, 200,000 ohms	1-117146
R8	Resistor, 800,000 ohms	1-117147
R9	Resistor, 3.75 megohms	1-117135
R10	Resistor, 45,000 ohms	1-117148
R12	Resistor, 150,000 ohms	1-117149
R13	Resistor, 1 megohm	1-117150
R14	Resistor, 4 megohms	1-117151
R15	Resistor, 15 megohms	1-117136
R16	Resistor, 11.2 ohms (bobbin)	10-805073
R17	Resistor, 0.452 ohm (bobbin)	10-805027

Reference Symbol	Description	Simpson Part No.
R18	Resistor, 22.5 ohms (bobbin)	10-805076
R19	Resistor, 2 ohms (bobbin)	10-805077
R20	Resistor, 80 megohms	1-117138
R21	Resistor, 20.2 megohms	1-117137
R22	Resistor, 0.025 Shunt Assy., 10 amp	0-007093
R25	Potentiometer, 10,000 ohms	1-115764
R26	Resistor, 7500 ohms	1-117152
R27	Rheostat, 4000 ohms	1-115767
R28	Rheostat, 4000 ohms	1-115767
R29	Resistor, 4000 ohms	1-117140
R30	Resistor, 4000 ohms	1-117140
R31	Rheostat, 4000 ohms	1-115767
C1	Capacitor, 0.1 μf, 400 v.	1-113733
D1	Rectifier, Germanium	1-117139
D2	Rectifier, Germanium	1-117139
	Test lead set (one red and one black)	7500
	Bakelite case (less handle)	3-320141
	Carrying handle plastic cover	1-115316
	Knobs;	
	For Function switch	1-115789
	For Range switch (less set screw)	3-260180
	For Zero Ohms Adjust	1-115790
F1	Fuse, 1 amp, 250 volt, pigtail type 3AG or equivalent	1-117702

Reference Symbol	Description	Simpson Part No.
	Cover Assembly (This includes cover glass glazed into bakelite frame and associated hardware. NOTE – Standard glazing compounds can not be used for re-glazing)	0-005674
	Cell, 1½ V., #2, Size D	1-111798
	Cell, 1½ V., Size Z	1-111802
	Meter Assembly (This includes engraved panel, meter, dial, mirror, and cover assembly)	15-302270
	Carrying handle insert (aluminum handle without plastic covering)	3-810427
	Set screw (for knob 3-260180)	1-114178

SECTION IV

APPLICATIONS

The Volt-Ohm-Milliammeter, commonly called the Multimeter, has developed into one of the most valuable instruments in all electrical and electronic fields. The applications of the Multimeter are so numerous and varied that, without exception, they can be said to cover the entire field of electrical measurements.

Your Model 270 Multimeter has been carefully engineered to produce the most accurate, dependable and rugged instrument consistent with modern design techniques for the many applications in which it will be used. In view of the practically unlimited number of applications, it is suggested that text books be referred to regarding this subject in order to fully utilize the versatility of this instrument.

SIMPSON WARRANTY REPAIR STATIONS AND PARTS DEPOTS

**Arizona, Phoenix — Area Code 602
Metercraft Inc. — CRestwood 9-6249
3308 N. 24th St.
States: Arizona

California, Los Angeles — Area Code 213
Quality Electric Company — ADams 2-4201
3700 South Broadway
States: So. California below Fresno and Arizona

California, San Francisco — Area Code 415
Pacific Electrical Instrument Lab. — Garfield 1-7185
111 Main Street
States: No. California above Fresno and Nevada

**Canada — Area Code 519
Bach-Simpson Ltd. — GLadstone 1-9490
1255 Brydges Street
P.O. Box 484
London, Ontario Canada

Colorado, Denver — Area Code 303
Meter-Master Instrument Service — 934-4601, 934-4069
2145 S. Kalamath Street
States: Wyoming, Colo., and New Mexico

Connecticut, New Haven — Area Code 203
Kaufman Instrument Labs Inc. — SPruce 6-7201
810 Dixwell Avenue
States: Connecticut

Florida, Orlando — Area Code 305
Electro Tech Inc. — GArden 3-5589
Florida Division
307-27th Street
States: Florida

* Parts Depots only; no repairs.
** Repair Stations only - no resale of parts.
(All other stations repair instruments and sell repair parts)
*** Parts Sales - Texas, Oklahoma
Repair -- Texas only.

Georgia, Atlanta — Area Code 404
Electro-Tech Inc. — 758-7205
690 Murphy Ave. S.W.
States: Alabama, Georgia and Tenn.

**Illinois, Chicago — Area Code 312
Simpson Electric Company — EStebrook 9-1121
5200 W. Kinzie Street

*Illinois, Chicago — Area Code 312
Pacific Indicator Company — COlumbus 1-1330
5217 W. Madison Street
States: Chicago, Wisconsin and Indiana

**Kansas, Shawnee Mission — Area Code 913
Sturtz Instrument Co. — SKyline 1-4711
4705 Mission Road
States: Kansas

Louisiana, New Orleans — Area Code 504
Industrial Instrument Works — TWinbrook 5-5621
3328 Magazine Street
States: Arkansas, Mississippi and Louisiana

Massachusetts, Cambridge — Area Code 617
Alvin S. Mancib — UNiversity 4-2494
363 Walden Street
States: Vermont, New Hampshire, Massachusetts, Rhode Island and Maine

Michigan, Detroit — Area Code 313
Ram Meter Inc. — LIncoln 7-1000
1100 Hilton Road Ferndale
States: Michigan

Minnesota, Minneapolis — Area Code 612
Instrumentation Services Inc. — JA 1-6267
917 Plymouth Avenue N.
States: Minnesota, North and South Dakota

Missouri, St. Louis — Area Code 314
Scherrer Instruments — FOrest 7-9800
5449 Delmar Blvd.
States: Illinois below Peoria, Iowa, Missouri

New Jersey, Riverdale
A & M Instrument Service, Inc.
11 Hamburg Turnpike
States: N. Jersey
Area Code 609
MArket 4-7757

**New Mexico, Albuquerque
Western Instrument Lab. Inc.
1816 Lomas Blvd. NW
States: New Mexico
Area Code 505
243-3693

New York, Buffalo
Electrical Instrument Labs.
932 Hertel Avenue
States: New York State Except Met. New York
Area Code 716
EXport 2-2726

New York, Great Neck, Long Island
Simpson Instrument Service Corp.
130 Cutter Mill Road
States: Met. New York
Area Code 212
Murray Hill 3-0674
Area Code 516
Hunter 2-3103

New York, Long Island City
A & M Instrument Service Inc.
48-01 31st Avenue
States: Met. New York
Area Code 212
RAvenswood 6-4343

**New York, Syracuse
Syracuse Instrument Lab.
4895 South Avenue Box 96
Area Code 315
HYatt 2-1651

**New York, Vestal
Compton Industries Inc.
333 Vestal Parkway East
P.O. Box 351
States: Up-State New York
Area Code 607
PI 8-3349

North Carolina, Charlotte
Electro-Tech Inc.
3107 Cullman Avenue (Carolina Division)
States: North and South Carolina
Area Code 704
333-0326

Ohio, Cleveland
Weschler Electric Company
4250 W. 130th Street
States: Ohio and Kentucky
Area Code 216
CLearwater 1-4609

**Oklahoma, Tulsa — Area Code 918
Tri-State Instrument Lab. — WE 6-0489
3244 East 15th Street
States: Oklahoma

**Oregon, Portland — Area Code 503
The Instrument Laboratory — BElmont 4-6683
1910 N. Killingsworth St.
States: Oregon

Pennsylvania, Philadelphia — Area Code 215
Sunshine Scientific Instrument — ORchard 3-5600
1810 Grant Avenue
States: Penn., Md., New Jersey below Trenton, Delaware

***Texas, Dallas — Area Code 214
Ultra Instrument Laboratories — TAylor 6-6395
3515 Swiss Avenue, Suite 117 — 6-6396
States: Oklahoma, Texas

Utah, Salt Lake City — Area Code 801
Stabro Laboratories, Inc. — IN 7-8011
23 Kensington Avenue
States: Utah, Southern Idaho

Virginia, Falls Church — Area Code 703
United Instrument Lab. Inc. — JEfferson 2-1212
102 West Jefferson St.
States: West Virginia, Virginia and Wash. D.C.

Washington, Seattle — Area Code 206
The Instrument Lab. Inc. — ATwater 3-5850
934 Elliott Avenue West
States: Oregon, Washington Idaho and Montana

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(All other stations repair instruments and sell repair parts)
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Repair -- Texas only.

WARRANTY

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

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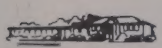
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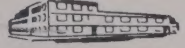
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